USGS

WATER RESOURCES RESEARCH GRANT PROPOSAL

Title: Particulate Transport of Mercury through Forested Watersheds

Duration: 1 September 1996 to 31 August 1998

Federal Funds Requested: $55,837

Non-Federal Funds Pledged: $107,835

Principal Investigators: E.A. Nater and D.F. Grigal; Department of Soil, Water, and Climate; University of Minnesota

Congressional District: 4

Critical Problem:

One of the Upper Great Lake Region's most important public environmental concerns is mercury (Hg) in surface waters and fish. This problem is also of concern in most of Scandinavia, eastern Canada, the northeastern U.S., and Florida. Fish consumption advisories have been issued for many lakes and rivers; even fish in lakes in remote wilderness areas such as the Boundary Waters Canoe Area of Minnesota are contaminated with elevated mercury. The elevated Hg is generally acknowledged to be the result of atmospheric deposition. Input of Hg to aquatic systems is by both direct deposition to the lake surface and by transport from the terrestrial watershed. Studies have shown that 6 to 60% of the Hg occurring in lakes originates from the terrestrial watershed. Concern has also been expressed that forest harvesting and other land management activities may increase the transport of Hg from terrestrial to aquatic systems.

A review and synthesis of the literature indicates that surface waters where Hg is a concern are also characterized by relatively high levels of organic carbon (OC). These high levels of OC are usually related to the presence of peatlands in the landscape. We are currently completing a study of movement of Hg via all hydrologic pathways, including atmospheric deposition in the open and through the canopy, runoff and flow through the soil (including peatlands), and streamflow, in forested watersheds in northern Minnesota. One of our most intriguing preliminary, results relates to the role of organic particulates in transporting Hg . Although only about 10% of the hydrologic flux of OC was associated with the difference between total and dissolved OC (operationally defined as particulate OC), we found that particulate OC was associated with approximately *65%* of the annual transport of Hg from six watersheds This preliminary result, if substantiated by more detailed investigation, will both provide further knowledge about Hg movement aquatic systems, but more importantly will provide a focus for evaluating anti ameliorating such movement associated with forest management activities.

Results and Benefits;

Knowledge of the nature of Hg movement from terrestrial to aquatic systems will be valuable as control measures for transport of Hg are developed and evaluated. This work will: 1) ascertain the quantity and character of particulate movement of Hg in relatively undisturbed forested watersheds, and (2) will conduct manipulations of the surface layers in the same systems to evaluate potential mobilization of particles and the effectiveness of buffer strips in minimizing particle movement.

These results will provide the basis for determining the adequacy of current Best Management Practices (BMPs) for forest management operations with respect to minimizing H contamination of aquatic systems. Such plans, currently in place to protect water quality from sediment and phosphorus contamination, may also be adequate to control Hg movement. If evidence indicates that they are inadequate, then they will require modifications in order to preserve water quality and human health in the Upper Great Lakes region and elsewhere. Because methylmercury (meHg) is the most bioaccumulative species of mercury found in natural systems, major research efforts are being expended to find ways to reduce meHg concentrations in surface waters by management of in-lake processes to decrease the rate of methylation or increase the rate of demethylation. An alternative method of decreasing meHg concentrations in waters is to limit the quantity of total Hg inputs to the aquatic system. One of the most cost-effective and easiest to implement methods of reducing Hg inputs to surface waters may be via BMPs.